

<https://gospodarkainnowacje.pl>**GOSPODARKA I INNOWACJE****Volume: 74 / 2026****Economy and Innovation****ISSN: 2545-0573**For more information contact: editor@gospodarkainnowacje.pl

IMPROVING THE METHODOLOGY FOR DEVELOPING STUDENTS' INDEPENDENT LEARNING AND RESEARCH ACTIVITIES BASED ON PROJECT-BASED LEARNING TECHNOLOGY

Suyunova Marjona Khudoysshukur qizi

Uzbekistan State Institute of Arts and Culture

Second-year Master's Student

ARTICLE INFO.

Keywords: project-based learning technology, independent learning and research activities, cognitive development, facilitation, tutoring, STEAM education, reflective analysis, criterion-based assessment, methodological improvement, research competence.

Abstract

This research comprehensively analyzes the pedagogical and methodological mechanisms for developing students' independent learning and research activities through Project-Based Learning (PBL) technology in the context of the modern educational paradigm. The article examines the stages of developing cognitive, inquiry-based, and practical competencies among primary and secondary school students, methods for classifying project-based tasks, and ways of implementing interdisciplinary integration (STEAM) in the educational process. It also presents scientific and practical recommendations and assessment criteria for monitoring students' independent research activities, conducting reflective analysis, and improving teachers' facilitation and tutoring functions.

<http://www.gospodarkainnowacje.pl/>©2026LWAB

Introduction

Fundamental reforms and digital transformation processes taking place in the global educational space require a conceptual transformation of traditional approaches to developing learners' knowledge, skills, and competencies. In an environment where the volume of information is increasing at a geometric rate, academic education focused on delivering ready-made theoretical knowledge is losing its practical and social effectiveness [1]. Today, one of the highest priorities of the education system is to develop students' independent learning and research activities, enabling them to acquire knowledge independently, filter information, analyze problematic situations, and find innovative and hypothesis-based practical solutions. Project-Based Learning (PBL) technology serves as a leading pedagogical driver and methodological tool for achieving this objective [2].

The theoretical and methodological foundation of project-based learning technology is based on the concepts of constructivism (J. Piaget, L. Vygotsky) and pragmatic pedagogy (J. Dewey, W. Kilpatrick). According to these theories, knowledge is not objectively transmitted from outside; rather, it is constructed

Kielce: Laboratorium Wiedzy Artur Borcuch



through the learner's activity and interaction with the environment. Project-based learning transforms the student from a passive recipient of information into an active researcher and project author. Independent learning and research activity is a complex cognitive process that requires the concentration of the student's intrinsic motivation, need for learning, and intellectual resources [3], [4], [5].

Methodology

The methodology for developing students' independent learning and research activities through project-based learning includes several logically interconnected and consistently implemented stages:

1. **Problem Formulation and Goal Conceptualization:** With the teacher's assistance or independently, students identify a problem arising in real life, scientific research, or social practice. At this stage, cognitive interest is stimulated and hypotheses are put forward.
2. **Planning and Design of an Independent Research Trajectory:** Project groups or individual students identify information sources (digital libraries, scientific articles, experimental data), research methods (observation, surveys, modeling, experiments), and allocate time resources.
3. **Information-Research and Experimental Stage (Data Collection and Analysis):** This stage is the core of independent research activity. Students collect data, organize it into logical groups, identify relationships and cause-and-effect connections, and test their initial hypotheses in practice.
4. **Project Product Creation and Synthetic Integration:** The results of the research are transformed into a specific practical product (a model, software, methodological recommendation, scientific report, social video, etc.).
5. **Presentation and Reflection:** Students present and defend the results of their research before the public and experts, assess themselves and their peers, and conduct a reflective analysis of mistakes made and achievements gained.

Result and Discussion

The research identified several important areas and mechanisms for improving the project-based learning methodology.

First, a transformation of the teacher's role is necessary. In a traditional lesson, the teacher is the sole source of knowledge, whereas in project-based learning, the teacher acts as a facilitator (one who facilitates and guides activities), tutor (one who monitors an individual learning trajectory), and expert [6]. The teacher does not offer students ready-made solutions; instead, through guiding and logical questions, the teacher encourages them to reach independent conclusions.

Second, the STEAM (Science, Technology, Engineering, Arts, Mathematics) approach and interdisciplinary integration are important. Modern problems (for example, ecology, energy, and digitalization) are rarely solved within the framework of a single subject [7], [8], [9]. Incorporating interdisciplinary modules into the project-based learning methodology develops students' ability to perceive problems holistically and systematically (systems thinking).

Third, a criterion-based and formative assessment system should be introduced [10], [11]. When assessing independent learning and research activities, it is necessary to evaluate not only the final product but also the research process itself, including students' activity, information literacy, critical thinking, and teamwork skills [12]. For this purpose, rubrics and portfolio methods are widely used [13].

Pedagogical experimental studies and analyses show that lessons and extracurricular activities organized on the basis of project-based learning technology not only improve students' academic achievement but also significantly develop their soft skills, including creativity, communication, critical thinking, and time management. Students continuously gain experience in conducting research, carrying out experiments, and scientifically substantiating their ideas [14], [15].

Conclusion

In conclusion, improving the methodology for developing students' independent learning and research activities based on project-based learning technology is a strategic factor in increasing the competitiveness of the education system and learners' life competencies. Systematically and gradually introducing this methodology into educational practice, enhancing teachers' project-based competencies, and creating a flexible and digital learning environment will contribute to the development of modern professionals capable of innovative thinking.

References

- [1] J. W. Thomas, *A Review of Research on Project-Based Learning*. San Rafael, CA, USA: The Autodesk Foundation, 2000, 46 p.
- [2] R. J. Ishmuhammedov and M. Yuldashev, *Innovative Technologies in Education: Teaching and Methodological Guide*. Tashkent, Uzbekistan: Iqtisod-Moliya, 2020, 278 p.
- [3] J. Larmer, J. Mergendoller, and S. Boss, *Setting the Standard for Project Based Learning*. Alexandria, VA, USA: ASCD, 2015, 235 p.
- [4] B. X. Khodjaye, *Theory and Practice of General Pedagogy*. Tashkent, Uzbekistan: Sanoat-standarti, 2021, 340 p.
- [5] W. N. Bender, *Project-Based Learning: Differentiating Instruction for the 21st Century*. Thousand Oaks, CA, USA: Corwin Press, 2012, 224 p.
- [6] J. S. Krajcik and P. C. Blumenfeld, "Project-based learning," in *The Cambridge Handbook of the Learning Sciences*, R. K. Sawyer, Ed. Cambridge, U.K.: Cambridge University Press, 2006, pp. 317–334.
- [7] E. I. Roziyev and M. S. Ashurova, *Methodology for Organizing and Developing Students' Scientific Research Activities*. Tashkent, Uzbekistan: Fan va texnologiyalar, 2022, 210 p.
- [8] P. C. Blumenfeld, E. Soloway, R. W. Marx, J. S. Krajcik, M. Guzdial, and A. Palincsar, "Motivating project-based learning: Sustaining the doing, supporting the learning," *Educational Psychologist*, vol. 26, nos. 3–4, pp. 369–398, 1991.
- [9] J. S. Krajcik and N. Shin, "Project-based learning," in *The Cambridge Handbook of the Learning Sciences*, 2nd ed., R. K. Sawyer, Ed. Cambridge, U.K.: Cambridge University Press, 2014, pp. 275–297.
- [10] J. Larmer and J. R. Mergendoller, "Seven essentials for project-based learning," *Educational Leadership*, vol. 68, no. 1, pp. 34–37, 2010.
- [11] C.-H. Chen and Y.-C. Yang, "Revisiting the effects of project-based learning on students' academic achievement: A meta-analysis investigating moderators," *Educational Research Review*, vol. 26, pp. 71–81, 2019.
- [12] D. Bell, "The project-based learning: An integrated approach to learning," *The Clearing House: A Journal of Educational Strategies, Issues and Ideas*, vol. 83, no. 4, pp. 39–43, 2010.
- [13] S. Kokotsaki, V. Menzies, and A. Wiggins, "A critical review of the literature on project-based learning," *Improving Schools*, vol. 19, no. 3, pp. 267–277, 2016.

- [14] J. S. Krajcik, B. Schneider, E. A. Miller, I. C. Chen, L. Bradford, Q. Baker, K. Bartz, C. Miller, T. Li, S. Codere, and D. Peek-Brown, “Assessing the effect of project-based learning on science learning in elementary schools,” *American Educational Research Journal*, vol. 60, no. 1, pp. 70–102, 2023.
- [15] G. Leggett and I. Harrington, “The impact of project-based learning (PBL) on students from low socioeconomic statuses: A review,” *International Journal of Inclusive Education*, vol. 25, no. 11, pp. 1270–1286, 2021, doi: 10.1080/13603116.2019.1609101.